

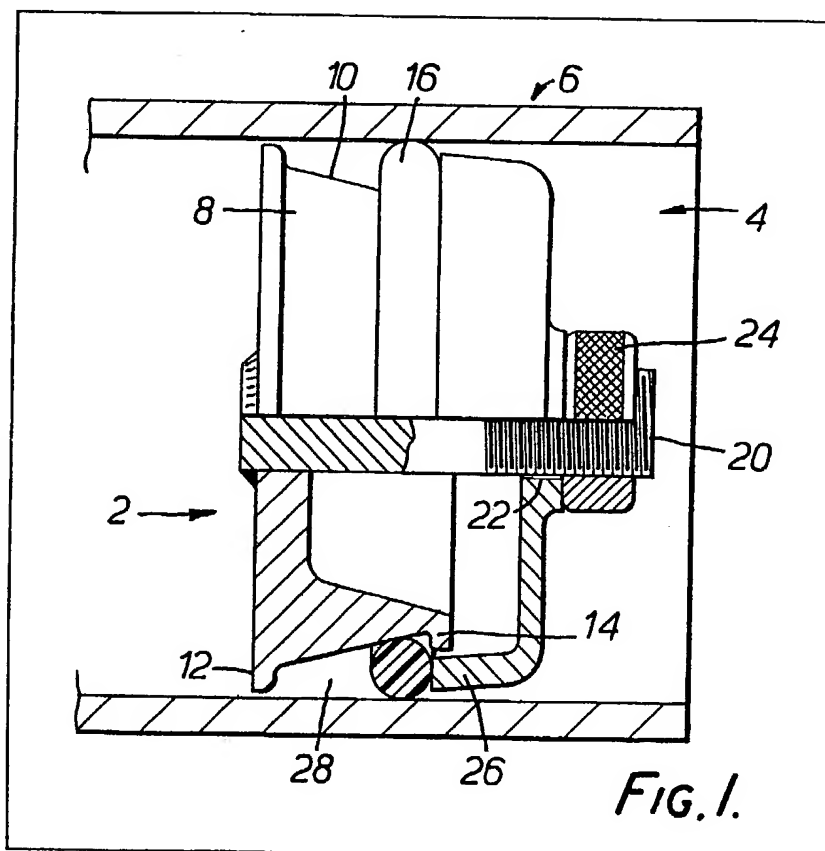
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(54) Pipe plug

(57) A pipe plug comprising a main body member 8 with a tapered portion 10, an elastomeric sealing ring 16 mounted on the taper and a locking member 18 connected to the main body by a coaxial threaded stud 20, the locking member preferably having a castellated circumferential flange

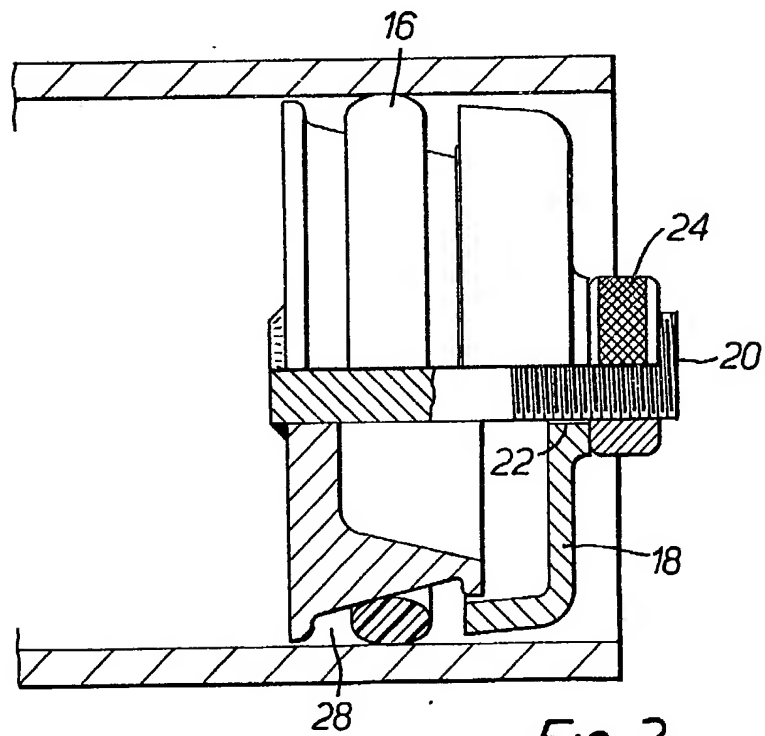
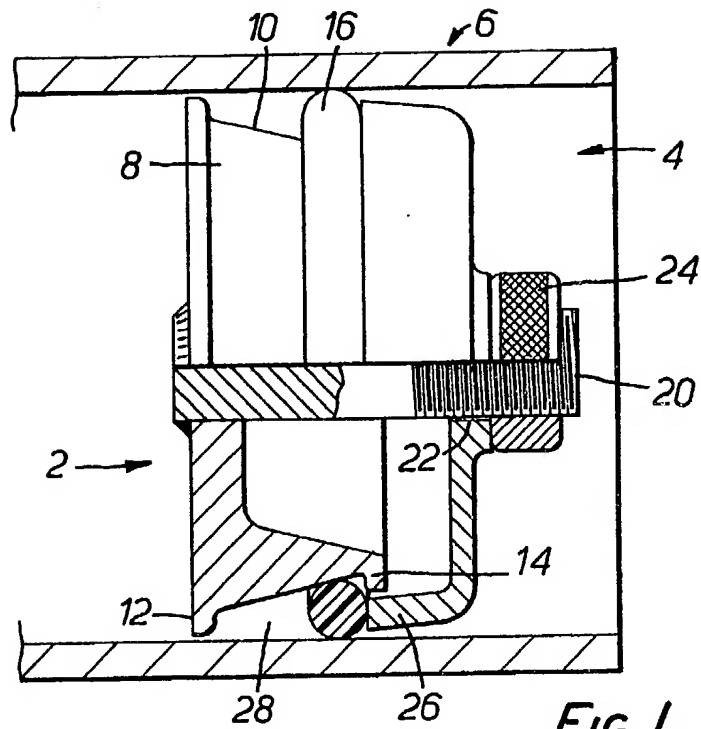
with locking segments in the apertures of the castellations. When the plug is tightened in the pipe under pressure, the flange 32 urges the ring 16 into the gap between the taper and the pipe to seal the pipe, and the locking segments are forced outwardly to engage the internal surface of the pipe and lock the plug into position.



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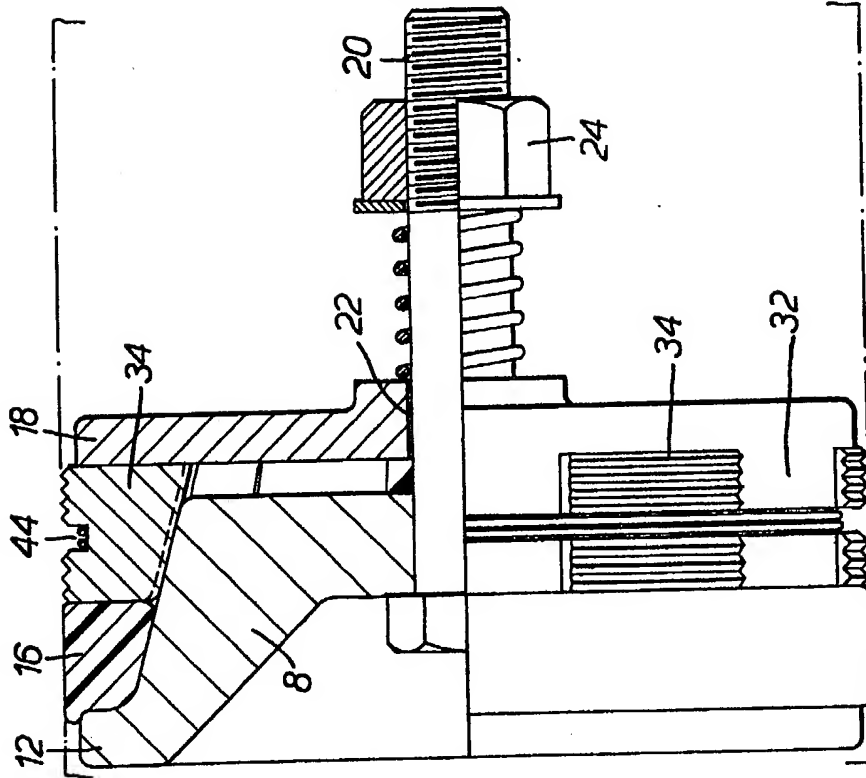


FIG. 4.

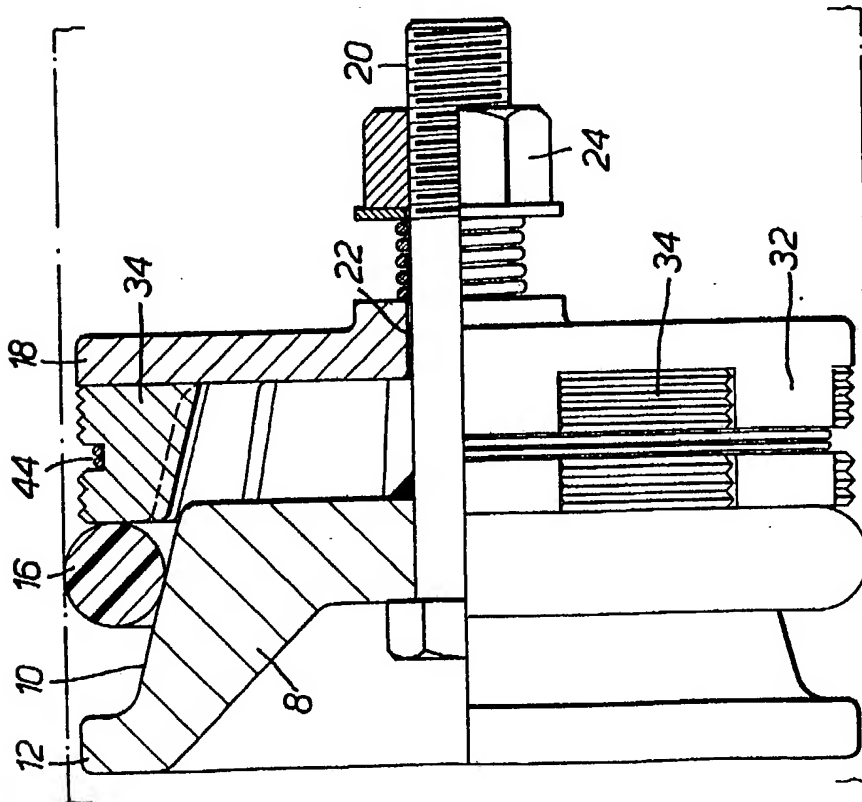
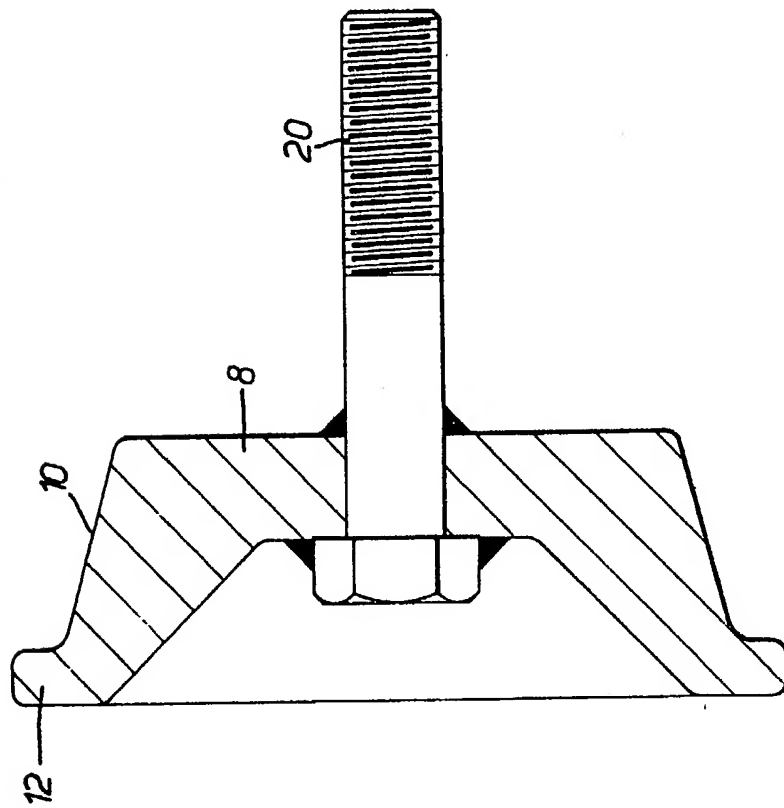
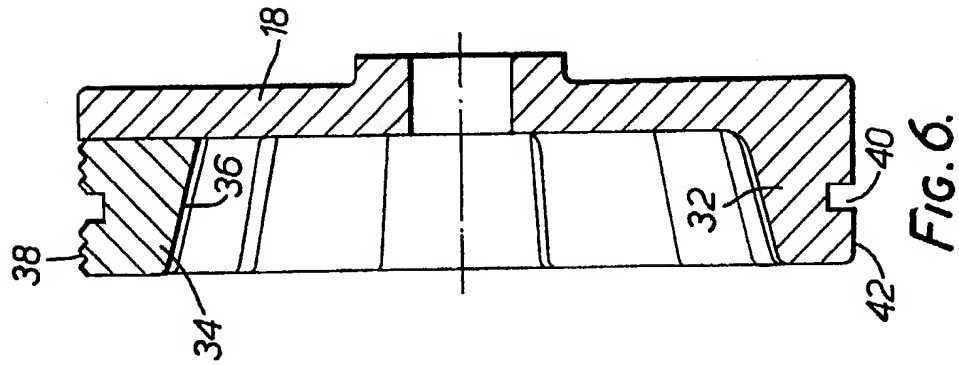


FIG. 3.

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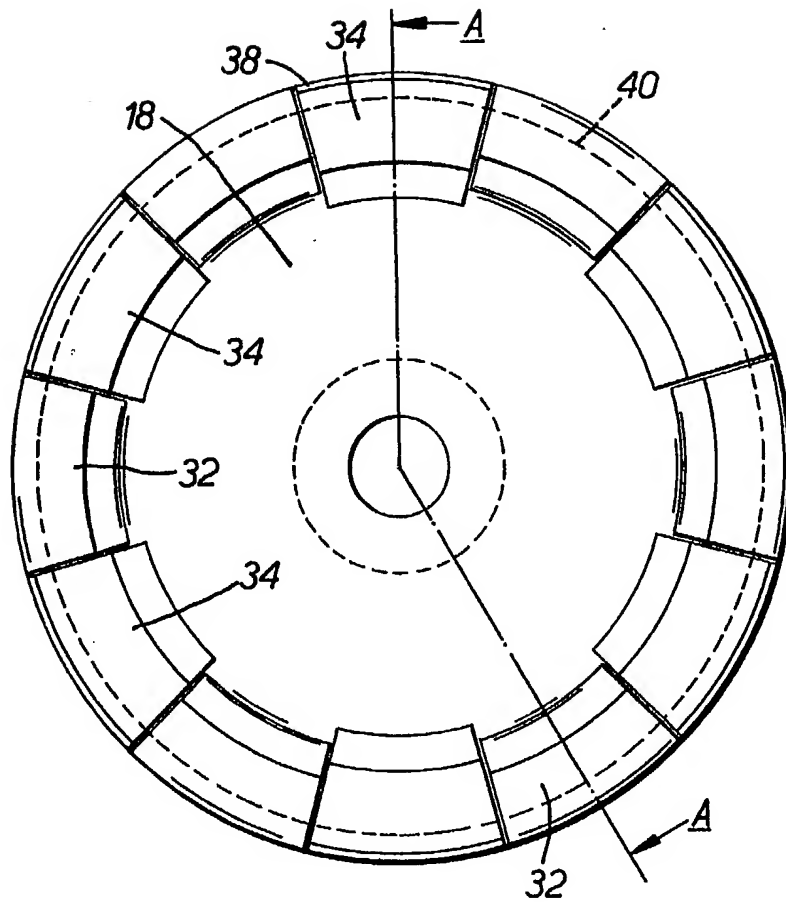


FIG. 7.

SPECIFICATION

Pipe plug

This invention relates to pipe plugs, and particularly to the type of plug which is used as a closure at the end of a pipe which contains gas or liquid under pressure. Such plugs are used frequently in the oil and gas industry.

There are a number of existing types of pipe plugs, some of which are very simple but can only withstand relatively low pressures, and others of which are more complex in construction, and can stand relatively high pressures. "Low pressure" in this context means up to about 2 bars or 30 p.s.i., whilst high pressure refers to pressures of up to 70 bars. The simpler types of plug usually comprise a pair of discs whose diameter is smaller than the inner diameter of the pipe, with a flexible sealing ring clamped between the peripheral edges of the two discs. The two discs are connected together in such a way that their relative positions can be adjusted to draw them closer together and compress the sealing ring so that it engages tightly with the inner wall of the pipe.

The higher pressure type of plug also works by clamping an annular seal between two relatively movable metal parts, but in addition it will typically incorporate sets of circumferentially spaced toothed metal members, which ride on cam surfaces of the plug and are forced into engagement with the inner wall of the tube, as the plug is tightened in the tube.

Accordingly, the present invention provides a pipe plug including a main rigid plug member having a body portion whose diameter varies from a maximum at one end which is just less than the inner diameter of the relevant pipeline, to a smaller diameter at the other end; a toroidal elastomer sealing ring which fits around the varying diameter portion, and a cooperating rigid locking member which is so shaped and so connected to the main plug member, that the two may be drawn together, in use, so as to cause the sealing ring to ride up the said portion of varying diameter, to engage with the internal surface of the pipe.

After the sealing ring has been engaged with the internal surface of the pipe, the application of further internal pressure in the pipe causes the plug to move outwards slightly, with the ring rolling up the portion of varying cross section, compressing the elastomer ring and wedging it into the gap between the plug and the pipe and so tightening the inter-engagement of the plug and the pipe. Therefore the greater the force on the plug body, the greater is the wedge action.

In one embodiment of the invention, the locking member has an axially extending flange around its circumference and is thus generally cup-shaped, with the internal diameter of the cupped portion being slightly larger than the diameter of the smaller end of the plug, so that the flange engages the sealing ring during the initial tightening stage. Preferably, the two rigid members are

interconnected by means of an axial stud, having a nut at one end which is tightened to draw them together. The stud may incorporate an axial bore, to allow the introduction or release of pressure.

In a preferred embodiment of the invention, the flange of the locking member is castellated, and radially movable locking segments are located in the apertures of the castellations and arranged to move outwardly, when the plug tightens under pressure, so as to engage the internal surface of the pipe. The locking segments are preferably retained by means of a circumferentially extending spring wire which is located in an annular groove in the external surface of the flange. The outer surface of each locking segment is preferably toothed or otherwise serrated so as to positively engage with the pipe.

Some embodiments of the invention will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a partially cross sectioned view of a first type of pipe plug at the initial stage of tightening;

Figure 2 is a similar view of the pipe plug of Figure 1, after the application of the working pressure in the pipeline;

Figure 3 is a view similar to that of Figure 1, of a second type of pipe plug;

Figure 4 shows the plug of Figure 3 after the application of working pressure in the pipeline;

Figure 5 is a cross-sectional view of a first plug member part of the plug of Figures 3 and 4;

Figure 6 is a cross-sectional view on the line A—A of Figure 7, of a second locking member part of the plug of Figures 3 and 4; and

Figure 7 is an end view of the locking member of Figure 6.

Referring firstly to Figure 1, the plug 2 is shown after it has been inserted into the end 4 of a pipeline 6. The plug comprises a first rigid plug member 8, which is formed with a tapered circumferential surface 10. It will be appreciated that this surface could, in practice, be curved in the axial direction. The tapered surface is terminated by a large diameter flange 12 at the inner end (relative to the end of the pipeline), and a smaller diameter flange 14 at the outer end.

A toroidal sealing ring 16 of elastomeric material is mounted around the surface 10 of the plug, and is of such a size that in the free state, that is to say when no working pressure is applied, it takes up a position at the smaller end of the main plug body 8, adjacent the flange 14.

A generally cup shaped locking member 18 having an axially extending circumferential flange 26 is axially connected to the body 8 by means of a stud 20 whose inner end is fixed to the centre of the body 8, and whose outer end passes through an axial bore 22 in the locking member, and carries a knurled nut 24 which retains the member 18.

In use, the plug 2 is positioned in the end of the pipe, at a short distance from the outer end, and the knurled nut 24 is tightened by hand, so that the flange 26 of the member 18 engages with the

sealing ring 16, urging it tightly into the gap 28 between the inner wall of the pipe, and the surface 10 of the plug. At this stage, the ring will be approximately in the position shown in Figure 1.

5 The amount of pressure that is applied to the ring at this stage is preferably not great, and is in practice limited by the amount of finger pressure that can be applied to the knurled nut 24.

When the working pressure of the pipeline is subsequently applied to the inner side of the plug 10 2, the plug is forced to move outwardly, rolling the sealing ring 16 between itself and the wall of the pipe, so that the ring becomes progressively more compressed in the tapering gap 28, as shown in Figure 2. When the force on the plug generated by the progressive compression of the sealing ring 15 balances the force generated by the internal pressure of the pipeline, the position of the plug will stabilise, and of course when the pressure is released from the pipeline, the plug will move 20 slightly to the left (inwardly of the pipe) as shown in Figure 2, releasing itself so as to allow its removal from the end of the pipeline. It will be appreciated that in practice, the stud 20 will normally have an axial bore closed by a removable plug at the outer end, to allow the pressure to be relieved.

The plug assembly of Figures 3 to 7 is of basically similar construction to that of Figures 1 30 and 2, and corresponding parts have therefore been given the same reference numerals. The assembly thus comprises a main plug body 8 having a tapered surface 10 and an end flange 12 (Figure 5), a sealing ring 16 and a locking member 35 18 being connected to the body 8 by means of a stud 20 with a retaining nut 24 (Figures 3 and 4). In addition, a coil spring 30 located on the stud is arranged to urge the locking member 18 into engagement with the ring 16 when the plug is 40 inserted into the pipe end. As the nut 24 is tightened the spring 30 is compressed thus increasing the axial force exerted on the locking member 18 and thus the ring 16.

A further respect in which the embodiment of 45 Figures 3 to 7 is different from that of Figures 1 and 2, relates to the formation of the annular flange of the locking member 18. Whereas the flange 26 of the embodiment of Figure 1 is plain, the flange 32 of the second embodiment is formed 50 with castellations 34 as best seen in Figures 6 and 7. A locking segment 34 is located in each aperture of the castellations, and has a radially inward surface 36 which is tapered to cooperate with the taper 10 of the member 8, so that the 55 segment rides up the taper when the plug is tightened under pressure. The outer surface 38 of

the segment is toothed so as to then engage tightly with the inner surface of the pipe.

In order to retain the locking segments in 60 position in the plug, an annular groove 40 is formed in the outer surfaces 42 of the castellations 32 and in the corresponding portions of the surfaces 38 of the locking segments, and a spring wire 44 is located in the groove.

65 CLAIMS

1. A pipe plug including a main rigid plug member having a body portion whose diameter varies from a maximum at one end which is just less than the inner diameter of the relevant 70 pipeline, to a smaller diameter at the other end; a toroidal elastomer sealing ring which fits around the varying diameter portion, and a cooperating rigid locking member which is so shaped and so connected to the main plug member, that the two 75 may be drawn together, in use, so as to cause the sealing ring to ride up the said portion of varying diameter, to engage with the internal surface of the pipe.

2. A pipe plug according to claim 1 in which the 80 locking member comprises a disc having an axially extending circumferential flange whose internal diameter is slightly greater than that of the smaller end of the plug so that the flange engages the sealing ring when the plug is tightened in the pipe.

3. A pipe plug according to claim 1 or claim 2 in which the body member and the locking member are interconnected by means of a coaxial stud having a nut at one end which is tightened to draw 85 them together.

4. A pipe plug according to any preceding claim further comprising a compression spring mounted on the stud between the nut and one of the said members so as to urge them into engagement.

5. A pipe plug according to any of claims 2 to 4 95 in which the said flange of the locking member is castellated, and a radially-movable locking segment is located in each aperture of the castellations and has a tapered inner surface so as to ride up the taper of the main body when the plug is tightened in the pipe so as to engage the 100 inner surface of the pipe.

6. A pipe plug according to claim 5 in which each locking segment has a toothed outer surface.

7. A pipe plug according to claim 5 or claim 6 105 further comprising an annular groove extending around the outer surfaces of the castellations and the locking segments, and a retaining ring for the locking segments located in the said groove.

8. A pipe plug substantially as herein described 110 with reference to Figure 1 and Figure 2, or Figures 3 to 7 of the accompanying drawings.